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EDITORIAL.

Production of Palm Oil.

The production of palm oil under plantation conditions renders it possible to obtain a quality of oil unequalled by the product from the forests of West Africa. Under plantation conditions the fruit can be harvested in the correct condition of ripeness and can be transported to the nearby factory without the delay which results in a high percentage of acidity in the oil as marketed. Immediately on arrival at the factory, the fruit bunches are subject to treatment with live steam which inhibits the enzyme action that causes acidity of the oil.

The procedure from harvesting to sterilising has been considerably improved as a result of the experience gained on estates during the past few years.

Likewise, factory methods are constantly being studied by the Department of Agriculture as well as by producers. The results of these endeavours are to be seen in improved efficiency in the factory, as judged firstly, by the very small amount of unrecovered oil and by the excellent and uniform quality of the oil.

The experimental factory at the Government Experimental Plantation, Serdang, is now in a position to contribute results of material value to oil palm producers. In the article contributed to the present number by Major C. D. V. Georgi on "The Centrifugal Extraction of Palm Oil at Serdang" the author adumbrates the procedure which is adopted in that factory and produces evidence of a high efficiency of production by that method. While much of this procedure is well known to producers, we would invite attention in particular to certain methods of manipulation which have been found to produce greater efficiency. For instance, the addition of 15 per cent. of fresh trash to the fruit before digestion overcomes a tendency for the mash to become sticky, for the fibrous residue to clog the screen, and of the nuts to be oily.

Methods of testing the efficiency of the process are given some prominence and should prove of great assistance to producers.

It should be remembered that the present article deals with but one method of oil extraction, and it is not to be implied that the author or the Department recommends this particular type of machinery in preference to other makes or systems. Similar work with the press system will be carried out and the results are to be published in this Journal in due course.

Indian Market for Copra.

In the July number of this Journal we directed attention, by means of an Editorial and of an article on Coconuts and Copra in 1931, to the importance of India as a market for high quality copra. It was pointed out that India not only consumes the whole of her Malabar production, but in 1931 took an increasing quantity of Ceylon copra. This resulted in a sharp rise in price on the European market for Ceylon copra. We further suggested that if Ceylon copra is to be permanently diverted to India it behoves Malaya to export an improved product to the European markets to replace the Ceylon supplies.

The Ceylon papers recently to hand publish a memorandum by the Minister of Agriculture and Lands, Ceylon recommending a cess on copra for the purpose of a propaganda campaign to extend the market for Ceylon coconut products in India.

In the ordinary way we should not have referred to this matter, which is the concern of Ceylon alone. In view, however, of the fact that the Minister of Agriculture and Lands freely quotes in his memorandum, the editorial and article from this Journal, it is perhaps well that some explanation be given in this place of the attitude of this Department concerning copra research work carried out in Malaya.

It is possible that some may consider that the interests of Malaya are antagonistic to those of Ceylon; that we are, in fact, by our efforts to improve the quality of the Malayan product, attempting to capture the Ceylon market.

This of course is not the case. We realise that with an improved product we shall be able to command a better price for our copra owing to the increased value of the copra to the crushers. Our references to the increasing importance to Ceylon of her Indian market, however, cannot but be of interest to Malaya because it indicates that Europe will have to obtain from other sources the supplies of high grade copra to replace any shortage of supplies from Ceylon. We are ambitious enough to hope that Malaya may be able to satisfy this demand should it arise.

It is perhaps relevant again to remind our readers, that the copra research work in Malaya is partly paid for by the Empire Marketing Board and that the results of this work are, through our publications, available to producers the world over. A comparison of Ceylon and Malayan conditions of copra preparation are stated in detail in the Special Bulletin of this Department: "Investigations on Coconuts and Coconut Products" by Mr. F. C. Cooke, Assistant Chemist for Copra Investigations. The author visited Ceylon in this connection and obtained very great assistance in his investigations from both officials and planters in that Island.

The endeavours of Ceylon to widen the market for her copra is of importance to the Empire; similarly our attempt to improve the quality of Malayan copra has a value not confined to this country. Our aims are not antagonistic but are in fact complementary to those of Ceylon.

Original Articles.

THE CENTRIFUGAL EXTRACTION OF PALM OIL AT SERDANG

BY

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Introductory.

The present article summarises the results to-date of various experiments carried out regarding the factory treatment of oil palm fruit to which reference was made in a previous number of this Journal, Vol. XIX, No. 8, August 1931.

As will be seen from the proposed scheme of work outlined in that article each experiment had for its object the determination of the optimum conditions for a particular stage in order to secure the maximum efficiency for the whole process. It is proposed, therefore, first of all to record the results of the individual experiments and then to describe briefly the present process with special reference to its efficiency.

It is to be regretted that owing to a breakdown with the Stork press it has not yet been found possible to compare the efficiencies of the press and the centrifugal processes; the present paper deals, therefore, only with the centrifugal process for the treatment of the fruit. The results of the comparative experiments with the press and the centrifugal extractor will be published in a further paper.

Sterilisation of Fruit.

The original procedure was to subject the fruit to the action of live steam for a period of one hour, but experiments have shown that this period can be reduced to 45 minutes without either affecting adversely the resultant acidity of the oil or necessitating an increase in the period of digestion. In this connection, it should be remembered that the preliminary sterilisation of the fruit serves a double purpose, the inhibition of enzyme action and the softening of the fruit, the latter being of importance as regards the subsequent digestion of the fruit and extraction of the oil.

The present procedure is, therefore, to sterilise the fruit for 45 minutes, live steam being admitted in quantity for approximately 10 minutes until the temperature of the fruit has been raised to approximately 100°C.; the supply of steam is then reduced until only a very small amount escapes through the lid of the steriliser, these conditions being maintained for the remainder of the period of treatment.

The object of the rapid heating of the fruit at the commencement of the operation is to inhibit as quickly as possible enzyme action developing as a result

of the inevitable further bruising associated with the handling of the cleaned fruit in the factory.

During the process of sterilisation a small amount of oil exudes from the fruit and escapes with the condensed steam. The mixed liquid from the sump below the sterilisers is therefore collected and transferred to the sludge treatment tank in order to recover the oil.

Digestion of Fruit.

Since there is no doubt that, as far as the recovery of oil is concerned, the digestion of the fruit is the most important part of the centrifugal process, particular attention was paid to a study of the conditions necessary to ensure the best results. In this connection it may be mentioned that with the Manlove Alliott closed type digester there are three variables (*a*) the period of digestion (*b*) the steam pressure in the jacket of the digester (*c*) the steam pressure in the body of the digester; so that it was arranged to study each variable separately, the other two being maintained constant during the experiments.

Further, as a measure of comparison of results it was decided to utilise the figure for the oil content of the pericarp residue, calculated on a moisture-free basis, remaining after centrifugal extraction under controlled conditions.

Period of Digestion: The original procedure was to digest the sterilised fruit for 25 minutes, maintaining excess steam pressures of 45 lbs. per square inch in the jacket of the digester and 5 lbs. per square inch in the body.

A series of observations in which these pressures were maintained constant but the period of digestion was varied showed that a period of 25 minutes, especially with fully-developed ripe fruit, was barely sufficient to effect complete disintegration, better results being obtained by extending the period to 30 minutes. It was found that if digestion was only carried out for 25 minutes there was frequently a small proportion of undigested fruit, the presence of the latter becoming still more marked if the period was reduced to 20 minutes.

These observations were confirmed by the results of analysis of average samples of the pericarp residue from the centrifugal extractor as the following figures for the oil contents, calculated on a moisture-free basis, show:—

Period of digestion	Oil content of residue
minutes.	(Moisture-free basis)
	per cent.
20	29.6
25	28.1
30	25.5

Further, another series of experiments showed that there was no advantage to be gained by prolonging the period of digestion to 35 or 40 minutes, in fact the results of analysis of samples of pericarp residue from fruit digested for these periods showed that there was a tendency for the oil content of the residue to increase compared with that for fruit digested for 30 minutes. It appears as if as a result of the prolonged period of digestion the mash is apt to become

thick and gummy and to retain a slightly increased amount of oil as the following figures show:—

Period of digestion	Oil content of residue (Moisture-free basis)
minutes.	per cent.
25	25.9
30	22.7
35	24.8
40	25.1

With regard to the discrepancies between the figures for the oil contents of the pericarp residue from fruit digested for the same period on different occasions it is considered that these are due to variations in the oil content of the mixed fruit, a considerable proportion of the fruit then harvested being obtained from comparatively young palms. In spite of the discrepancies it is considered that the results for the two series of experiments are sufficiently accurate to enable the above conclusions to be drawn.

Steam Pressure in Jacket: As regards the excess steam pressure in the jacket of the digester, a further series of experiments in which the fruit was digested for 30 minutes and the excess steam pressure in the body of the digester maintained at 5 lbs. per square inch showed that an excess steam pressure of 45 lbs. per square inch in the jacket was unnecessary. With such a pressure the mash, especially with fully ripe fruit, is apt to thicken and to retain an increased amount of oil. A high steam pressure in the jacket has the same effect therefore as a prolongation of the period of digestion.

It was found that better results were obtained with an excess steam-pressure in the jacket of only 15/20 or even 5/10 lbs. per square inch, that is, merely enough steam to maintain the lining of the digester at a temperature slightly greater than 100°C.

The following figures for the oil contents of samples of the pericarp residue, calculated on a moisture-free basis, show the extent of the variations.

Steam pressure in jacket	Oil content of residue (Moisture-free basis)
lbs per square inch.	per cent.
45/50	28.5
35/40	27.1
25/30	26.0
15/20	24.8
5/10	25.4

As mentioned previously, fully ripe fruit was used for the experiments, which were carried out during the months of August/September when it would appear that the oil content of the fruit shows a slight seasonal increase corresponding with the maximum harvest. This would account for the slightly higher figures for oil content of residue recorded in the table compared with others previously given for fruit treated under the same conditions,

Steam Pressure in Body: The results of experiments in which the fruit was digested for 30 minutes and the excess steam pressure in the jacket kept constant at 5/10 lbs. per square inch, only the steam pressure in the body being varied, showed that an excess steam pressure of only 5 lbs. per square inch in the body was required. If a higher body steam pressure was maintained or the fruit was digested without steam the mash tended to become thick and gummy and to retain oil, as indicated by a slight increase in the oil content of the pericarp residue.

The figures in the following table show the extent of the variations, consequent upon the changes in steam pressure in the body of the digester.

Pressure in body of digester	Oil content of residue (Moisture-free basis)
lbs. per square inch.	per cent.
Nil.	29.5
5	24.3
10	27.6

As a result of the whole investigation it was decided therefore to digest the sterilised fruit for 30 minutes, excess steam pressures of 5/10 lbs. per square inch and 5 lbs. per square inch being maintained in the jacket and the body of the digester respectively.

Centrifugal Extraction of Oil.

Provided the digestion of the fruit has been satisfactory, the centrifugal extraction of the oil calls for little comment, except that it is essential to ensure that the normal speed of the extractor, 900 revolutions per minute, is maintained.

The mash from the digester is treated for a period of 15 minutes in the extractor. No steam is admitted during the first three minutes of the process, the object being to expel the greater part of the oil, which flows readily as soon as the extractor commences to increase in speed. Steam at a pressure of 35—40 lbs. per square inch, as indicated by a pressure gauge fixed in the supply steam-pipe, is injected into the mass for 9 minutes, after which it is turned off, the basket being then spun for the remaining three minutes of the process. The object of running without steam for the last three minutes is to expel excess water and reduce the moisture content of the mass prior to the separation of nuts and fibrous residue in the depericarper screen.

A suggestion was made that the oil content of the pericarp residue from the centrifugal extractor might be reduced and an additional quantity of oil recovered by breaking down the residue in the basket, trimming the load and spinning for a further period of 10 minutes with the addition of more steam.

The results of experiments showed, however, that only a very small amount of additional oil could be recovered, the oil content of the residue, calculated on a moisture-free basis, being reduced on the average from 24 to 23 per cent. This reduction corresponds to an additional recovery of possibly 0.25 per cent. of oil, mostly in the form of sludge, so that the secondary treatment of the residue by this method would not appear to be economical.

Further, from the point of view of the upkeep of the centrifugal extractor, such a procedure is also not to be recommended on account of the tendency of the basket to deviate from an even running spinning motion consequent upon the difficulty of trimming the caked residue.

Washing of Crude Oil.

No difficulty has been experienced as regards the separation of the oil from the mixture of oil and water obtained in the centrifugal process.

The mixed liquid in the washing tank is boiled for 2 hours with live steam and allowed to settle for 16 hours. The oil and water will then be found to have separated almost completely with only a small amount of sludge between the two layers.

In view of the relatively large amount of cellular matter this is somewhat surprising, especially as the volume of the oil is rather greater than twice that of the water and no water, other than the small amount of steam which condenses during the boiling, is added.

The oil content of the wash water varies from 0.05 to 0.10 lbs. per gallon so that, apart from the sludge that is subjected to a secondary treatment, the loss of oil in the water run off from a tank containing say 160 gallons (1440 lbs.) of oil is only approximately 6 lbs.

Experiments show that the total solids in the water from the washing tanks amount to approximately 10 per cent. These solids consist principally of organic matter; for example, gummy substances and fruit juices leached out during the process of extraction.

As regards the mineral constituents analyses show that the phosphoric acid content, calculated as P_2O_5 , amounts to approximately 0.08 lbs. per gallon while the potash content, calculated as K_2O , may be as much as 0.23 lbs. per gallon. Although these figures indicate that the liquid is comparatively rich in these plant constituents, the extent of their availability is doubtful in view of the large proportion of mucilaginous matter present.

Treatment of Sludge.

After as much clean oil as possible has been drawn off through the main oil-cock the remaining liquid, usually referred to as sludge, is run off from the bottom of the tank for further treatment as regards recovery of oil. For a full charge the volume of sludge amounts to approximately 20 gallons, this figure representing the volume of the tank space below the level of the main oil-cock.

The sludge is passed through a coarse sieve to remove any small nuts and fibrous residue that may have passed over with the crude oil from the centrifugal extractor and diluted with an approximately equivalent volume of water.

The mixed liquid is boiled with live steam for two hours in an open tank and allowed to settle for 16 hours, the treatment being similar to that employed for the crude oil.

A satisfactory separation is obtained with practically no sludge between the oil and water layers. As will be realised, however, on account of the diameter of the tank it is not convenient to effect a complete separation of oil and water, so that when as much oil as possible has been drawn off the balance of the liquid is retained in the tank and mixed with the next charge of sludge.

Purification of Oil.

The oil from the washing tanks and the sludge treatment tank is passed through a fine mesh metal gauze filter to remove the small amount of fibrous matter in suspension in the oil and is then collected in a cylindrical tank situated below ground level. This tank can be closed and steam admitted by means of a valve; this has the effect of forcing the oil from the tank along the pipe to the supply tank for the De Laval separator. Filtration of the oil is advisable on account of the liability of fibrous matter to collect in some part of the piping leading to the separator, thereby causing a stoppage.

Formerly, the oil before reaching the separator was washed again by upward passage through a tank filled with hot water. Experiments showed this additional washing to be unnecessary, at any rate with oil prepared by the centrifugal process, washed and settled in the manner described. The present procedure is therefore to heat the oil in the supply tank by means of closed steam coils to a temperature of approximately 75–80°C and deliver direct to the De Laval separator.

As regards the separator, it has been found by experiment that the best results are obtained with a gravity disc 089–092, 53 mm.

Provided the speed of the separator is maintained according to that specified by the makers, no difficulty has been found in removing practically the whole of the matter in suspension and maintaining the moisture content below 0.25 per cent. as the figures for the analyses of average samples of the oil for the past six months show :—

Month.		Moisture per cent.	Matter in suspension per cent.
January	...	0.24	Trace
February	...	0.25	Trace
March	...	0.23	Trace
April	...	0.24	Trace
May	...	0.22	Trace
June	...	0.20	0.01

Although the separator is said to have a purifying capacity of 110 gallons per hour, experience shows that to maintain the above high standard of quality of oil over a day's run the machine should only work at approximately half this capacity, that is, a barrel, 40 gallons, filled in approximately 40 to 45 minutes.

The small amount of oil-water emulsion discharged from the separator is returned to the sludge tank for treatment, thereby retaining as much as possible of the oil in the system.

Analyses of the black sludge deposited inside the bowl of the separator have shown the material to have the following composition:—

	per cent.
Moisture	... 73.9
Oil	... 12.3
Residue (by difference)	... 13.8
	100.0
Oil (on dry basis)	... 47.1

Although the oil content of the residue, calculated on a moisture-free basis, is relatively high, the amount of residue is small. Records show that the total loss of oil in the separator when purifying say 1 ton of oil is approximately $\frac{3}{4}$ lb. No attempt is made to recover this oil on account of the matter in suspension associated with it, especially as the former is in a very fine state of division.

Separation of Pericarp Residue and Nuts.

The separation of the pericarp residue from the nuts is effected by agitating the mass discharged from the centrifugal extractor in a revolving screen, usually referred to as a depericarper screen.

The screen is mounted with one end slightly higher than the other so that by feeding the material at the upper end, the nuts gradually travel along the screen to the lower end where they are discharged, the fibrous residue passing between the iron rods of which the sides of the screen are composed.

The screen, which is rectangular in shape, the sides being approximately 3 feet wide, is 16 feet long and divided into three sections, in each of which a different arrangement of rods has been made. The rods in each section are fitted into frames, which are interchangeable.

In the first section circular rods are fitted vertically to the axis of the screen, in the second the rods are similarly fitted but in this case they are rectangular and arranged diagonally in the frame, while in the third section the rods are circular and fitted horizontally to the axis of the screen.

No difficulty has been experienced as regards effecting a satisfactory separation of the fibrous residue and nuts, even though the residue contains approximately 50 per cent. of moisture. It is estimated that approximately 80 per cent. of the fibrous residue separates in the first section of the screen.

A certain amount of trouble was caused owing to a proportion of the small nuts being discharged with the fibrous residue. This was due to the rods ($\frac{3}{4}$ inch) being insufficiently strong to withstand the impact of the nuts, some of which would become firmly wedged, thereby causing the rods to bend slightly and permit smaller nuts to find their way between the rods. This was remedied by inserting cross bars where necessary so as to reduce the free length of the rods.

Further, it was noticed that when working with well developed fully ripe fruit, there was a tendency for the spaces between the rods to become choked,

thereby necessitating frequent cleaning. This is doubtless due to the stickiness of the residue consequent upon the presence of gummy substances in the fruit. The effect became, however, much less marked if the fruit was mixed with a small proportion of trash before treatment, the nuts discharged from the lower end of the screen being also less oily. The question of the addition of trash to the fruit before treatment will be referred to later.

Since there is no secondary treatment of the pericarp residue, the material from the screen is spread out to dry on the floor of the factory before being used as fuel for the boiler.

Drying and Cracking of Nuts.

The method adopted for drying the nuts follows that described in the *Malayan Agricultural Journal* for October, 1929. The clean nuts discharged from the screen are stored in bins for 12 to 14 days in order to reduce the moisture content of the kernels so as to ensure satisfactory cracking of the nuts, that is to prevent an undue proportion of damaged kernels.

Care is taken to keep each batch of nuts separate so as to maintain a regular period of storage, also after the period of storage to remove the wet nuts from the top of the pile and to crack only the dry ones. The wet nuts are incorporated into another pile of fresh nuts from the screen.

Although the nut cracker at present in use in the factory has only a small capacity, being an experimental machine purchased some years ago from Culley Expressors Ltd., satisfactory results have been obtained as regards the proportion of whole kernels after this period of storage for the nuts.

Manufacture of Kernels.

The kernels and shell fragments are separated by means of a suspension of clay in water in which, as is well-known, the kernels float while the shell fragments sink.

The kernels are washed to free them from adhering clay and dried in thin layers on the floor of the factory. The usual period of drying varies from 8 to 10 days.

The shell fragments are washed with water, allowed to dry and used as fuel for the boiler.

On account of the present relatively small output of kernels, approximately 1 ton per month, and the long period that must elapse before a sufficient quantity has accumulated to warrant shipment, all broken and damaged kernels are picked out before bagging. In this connection it may be mentioned that any kernels that float when the latter are washed with water are also rejected, since experience shows that such kernels are invariably unsound.

By storing only the whole kernels, the liability to deterioration during storage will be reduced to a minimum, since it is well known that damaged and broken kernels, in which the flesh is exposed to the air, are apt to become mouldy, the oil develops acidity and the quality of the whole consignment will suffer accordingly.

Summary of Process.

Having thus recorded briefly the results of the individual experiments relating to the various stages it seems advisable to summarise the conditions for the whole process. Before doing so, however, there are two points to which attention should be drawn (*a*) the addition of trash to the fruit before treatment (*b*) a slight modification in the pressure of digestion.

The original digestion experiments showed the importance of mixing the fruit before treatment, that is for each charge for the steriliser to consist as far as possible of a mixture of overripe fallen fruits, also outside and inside fruits stripped from the bunches. As explained previously, it was found, for example, that if fully developed ripe fruits were treated separately there was a tendency for the mash to become somewhat sticky and for the fibrous residue to clog the screen, while the surfaces of the nuts were apt to be oily.

Further, the oil content of the pericarp residue from such fruit, calculated on a moisture-free basis, might be as high as 32 per cent. compared with the average figure of 24 per cent.

Experiments showed that the recovery of oil from such fruits could be improved by the addition of a small amount of bunch trash before treatment. The addition of 15 per cent. by weight of fresh trash to such fruit before digestion brought about a reduction in the oil content of the residue, calculated on a moisture-free basis, from approximately 30 per cent. to 20 per cent. This is a greater decrease than that due to the addition of such a proportion of oil-free trash.

Further, the residue separates more easily in the depericarper screen, while the surfaces of the nuts are less oily.

As a result, therefore, it has been decided to leave a small proportion of trash with the fruit, the latter only being picked clean in the collecting sheds when such fruit is required for a particular experiment. In this connection it may be mentioned that the introduction of this modified method of separating the fruit from the bunches has resulted in a saving of the labour required in the collecting sheds.

As regards the variation in the pressure for digestion it was found that an excess steam pressure of 5/10 lbs. per square inch was hardly sufficient to heat the jacket of the digester rapidly enough at the commencement of the day's run to enable the optimum results to be obtained. Accordingly, the pressure in the jacket is now maintained at 15/20 lbs. until the first two charges have been digested, after which the pressure is reduced to 5/10 lbs. for the remainder of the day.

The whole process may therefore be summarised as follows:—

<i>Fruit</i>	Loose fruit, well mixed, still containing a small proportion of bunch trash.
<i>Sterilisation</i>	45 minutes with live steam. The hot fruit should be transferred as quickly as possible to the digester.

<i>Digestion</i>	30 minutes, 5 lbs. pressure in body, 15/20 lbs. in jacket for first two charges, 5/10 lbs. for remainder of working day.
<i>Centrifugal extraction</i>	15 minutes, steam injected from 3 minutes after starting to 3 minutes before stopping.
<i>Washing of crude oil</i>	2 hours boiling with live steam, settling for 16 hours. The proportions of oil to wash water after sedimentation should be approximately 2 of oil to 1 of water.
<i>Treatment of sludge</i>	The sludge is diluted with approximately its own volume of water, the liquid is boiled with live steam for 2 hours after which it is settled for 16 hours.
<i>Purification of oil</i>	The washed oil and the oil recovered from the treatment of the sludge are passed through a fine metal gauze filter and run direct to the De Laval separator.
<i>Treatment of centrifuge residue</i>	The pericarp residue is separated from the nuts in a revolving screen. The pericarp residue is used as fuel.
<i>Treatment of nuts</i>	The nuts are dried and cracked. The kernels are recovered, the shell fragments being used as fuel.

Efficiency of Process.

One result of the installation of a depericarper screen has been the possibility of making determinations of the efficiency of the process as far as recovery of palm oil, the more important constituent of the fruit, is concerned.

The efficiency of the process represents the amount of oil recovered compared with the total amount of oil present in a given weight of fruit. Taking the total amount of oil in the fruit as 100 it is usual to express the efficiency as a percentage.

With the relatively large amounts of fruit involved in factory treatment it will be realised that the total amount of oil in a given weight of fruit cannot conveniently be directly determined and must be calculated. The figure is accordingly arrived at by adding to the weight of oil recovered the calculated amounts of oil lost at various stages of the process, the waste products themselves being either weighed or measured, then sampled and analysed for oil content.

Much depends therefore on the sampling methods adopted, since, however accurate the analysis, the results of the latter will be of little value if the sampling is also not relatively accurate.

Sampling of Waste Products.

When commencing the process with loose fruit, oil is lost as follows:—

- (a) Pericarp residue,
- (b) Surface of the nuts,
- (c) Washing of crude oil,
- (d) Purification of sludge.

It was necessary therefore to devise methods for sampling each of these waste products.

(a) *Pericarp residue.* The pericarp residue falling between the rods of the screen was continually collected and weighed in baskets. Each basket held approximately 45 lbs. From every alternate basket 250 grammes (approximately $\frac{1}{2}$ lb.) of the residue was weighed and placed in a tin provided with a cover, the sample for analysis being eventually drawn from the contents of the tin.

Care was taken to ensure that the pericarp residue was practically free from nuts, since it will be realised that the presence of a small proportion of nuts would vitiate the results, especially if a small nut was drawn in the sample for analysis.

Further, the pericarp residue was mixed before weighing into baskets, since experiments have shown a slight increase in the oil content of this residue according to the distance which it travels along the screen. Material discharged between the rods at the lower end has a slightly higher oil content than that which passes through almost immediately at the upper end.

(b) *Nuts.* The nuts discharged from the lower end of the screen were collected and weighed in baskets. Each basket held approximately 90 lbs. From every alternate basket 500 grammes (approximately 1 lb.) of the nuts was weighed and placed in another tin provided with a cover, the sample for analysis being eventually drawn from the contents of the tin.

(c) *Washing of crude oil.* After the height of the level of the oil had been measured and the water was being run off, a sample (approximately 250 c.c.) was taken with each three inch reduction in level. Sampling was continued until oil appeared at the test cock on the tank, when the height of the level of the oil was again noted.

The small samples were bulked in a bottle from which the sample for analysis was drawn.

The tank had previously been calibrated so that the volume in gallons corresponding to the reduction in level, that is the amount of wash water, could be calculated.

(d) *Purification of sludge.* A similar procedure was adopted with the purification of the sludge, except that, owing to the smaller volume of liquid, a sample was taken with each two inch reduction of level.

Analysis of Waste Products.

The following procedure was adopted as regards the analyses of the bulk samples of waste products:—

(a) *Pericarp residue.* The bulk sample was quartered until approximately $\frac{1}{2}$ lb. of residue remained. A small sample (25 grammes) was weighed out accurately, dried in a steam-oven and treated with petroleum ether in a Soxhlet extractor. When extraction was complete, the solution of oil in petroleum ether was filtered, the solvent distilled off and the oil dried to constant weight.

(b) *Nuts.* The bulk sample of nuts was quartered until approximately 2 lbs. remained. A sample (80–90 grammes) was weighed out accurately, dried

in a steam oven for a few hours and treated with petroleum ether in a Soxhlet extractor, until all the oil had been removed from the surface of the nuts. The oil was recovered by a similar procedure to that described for the pericarp residue.

(c) *Washing of crude oil.* 50 c.c or ml. were measured into a porcelain basin, evaporated to dryness and the residue dried in the steam-oven. The dried residue was ground with a small quantity of fine sand and treated with petroleum ether in a Soxhlet extractor until the oil was completely extracted. The oil was recovered by a similar procedure to that described for the pericarp residue.

(d) *Purification of sludge.* A similar treatment to that described for the water from the washing of the oil was adopted in the case of the layer of water separating out after further treatment of the sludge.

Calculation of Results.

In order to show the method of calculation, an example from an actual test is given. It will be noticed that the weight of oil lost at any particular stage of the process is calculated by multiplying the weight or volume of the waste product by the unit figure for the oil content as determined by analysis.

FRUIT				lbs.
Weight of fruit treated ...	...	...	...	8,243
PALM OIL				
Weight of oil recovered ...	...	...	...	2,221
LOSSES OF OIL				
(a) <i>Pericarp residue</i>				
(lbs. of oil per lb. of pericarp residue)				
(i) 1272 x .1041	...	...	...	132.41
(ii) 953 x .1091	...	...	...	103.97
(b) <i>Nuts</i>				
(lbs. of oil per lb. of nuts)				
(i) 1533 x .0048	...	...	...	7.36
(ii) 1390 x .0051	...	...	...	7.09
(c) <i>Washing of crude oil</i>				
(lbs. of oil per gallon of water)				
(i) 72 x .06	...	...	...	4.32
(ii) 48 x .09	...	...	...	4.32
(iii) 59 x .08	...	...	...	4.72
(d) <i>Purification of sludge</i>				
(lbs. of oil per gallon of water)				
(i) 65 x .08	...	...	...	5.20
(ii) 62.5 x .08	...	...	...	5.00
Total				274.39

EFFICIENCY OF PROCESS				per cent.
2221	×	100	222100	
=			=	89.0
2221	+	274	2495	
OIL CONTENT OF FRUIT				
2495	×	100		
=			=	30.3
8243				

The results show that, commencing with fruit containing a small proportion of trash, approximately 89 per cent. of the total oil present in the fruit has been recovered.

The slightly low figure for the oil content of the fruit is due to the inclusion of the small proportion of non-oil-bearing trash. This point will be referred to again later.

Remarks and Conclusions.

Although only one example has been quoted it may be mentioned here that three tests, in which approximately the same amounts of fruit have been treated, have given similar figures as the following results show :—

Amount of fruit lbs.	Efficiency per cent.	Oil content of fruit per cent.	Remarks.
9,596	88.1	31.3	Clean fruit.
10,117	88.3	31.6	Do.
8,243	89.0	30.3	Fruit with trash.
12,622	88.4	30.4	Do.

It appears reasonable to assume therefore that the efficiency of the centrifugal process as described above is approximately 88.5 per cent.

Further, it will be realised that when commencing with fruit containing a proportion of trash the calculated figure for the oil content of the fruit is of little significance, unless the proportion of trash is known and the correct weight of fruit calculated.

As regards the distribution of the losses of oil, figures show that taking the total loss as 100 the percentage distributions are approximately as follows :—

	per cent.			
Pericarp residue	...	...	...	87.4
Nuts	...	...	...	6.1
Purification of oil	...	...	...	6.5
				100.0

Assuming that the average oil content of the fruit is 31.5 per cent. it can be calculated that the final distribution of the oil is approximately as follows :—

					per cent.
Oil recovered	...	...	...	...	27.8
Oil lost in pericarp residue			...	...	3.3
Oil lost on surface of nuts			...	...	0.2
Oil lost in purification	...	...	...	...	0.2
					31.5

General.

At present the yield of fruit from the area under cultivation is only sufficient to warrant the factory working two days per week, but with the greater productivity of the palms on account of increasing age and the extension of the area, the factory will have to be run more frequently to deal with the increased output.

In this connection it may be of interest to note that the weights of fruit treated and the amounts of oil recovered during the past four months have been as follows:—

Month.		Weight of fruit lbs.	Weight of oil lbs.	Recovery per cent.
March	...	41,648	11,257	27.0
April	...	63,283	17,182	27.2
May	...	39,835	10,929	27.5
June	...	41,459	11,242	27.1

The comparatively high figures for the percentage recovery of the oil are due partly to the fruit having been picked clean before weighing and partly to the loss of moisture occurring during storage in the collecting sheds and resulting in a lower weight being recorded for the fruit than would have been the case if the fruit had been treated fresh. In this connection it may be mentioned that the June figures recorded for the weight of fruit and the percentage recovery are not strictly comparable since during the last three weeks of that month the treated fruit contained a proportion of trash.

With regard to the quality of the oil the average acidity, calculated as palmitic acid, during the above period was approximately 4.45 per cent. As mentioned previously, the average moisture content was 0.22 per cent., while the matter in suspension was less than 0.01 per cent., being of the order of traces.

No comments can be offered at present on the quality of the kernels since manufacture has only commenced recently.

As far as can be judged the colour of the fresh kernels is satisfactory, occasional counts of the proportions of white and "off-colour" kernels show the latter to be present to the extent of only approximately 15 per cent. Average samples of kernels will, however, be taken for analysis when the first consignment is shipped.

IMPRESSIONS OF DANISH AGRICULTURE

BY

E. A. CURTLER,
Assistant Agriculturist.

The writer attended the International Dairy Congress at Copenhagen in 1931 as a delegate of the Straits Settlements and Federated Malay States. He availed himself of the opportunity thus offered of making some acquaintance with Danish agriculture. The following notes are compiled as a result of visits made to various places of interest near Copenhagen.

Over three quarters of the total area of Denmark is cultivated, the remainder being towns or land unsuitable for agriculture.

The land is divided into comparatively small holdings. Over 20 per cent. of the holdings are between 3.3 to 15 hectares each and a further 50 per cent. are of not more than 60 hectares.

The intensive cultivation of the land is usual. The cattle are tethered while grazing, the grazing being usually on fodder crops. Permanent pasture is seldom seen and rough pasture very rarely. Hedges are not grown.

The agriculturists are industrious, working practically all day in the fields.

Agricultural Museum.

The main objects of interest at the Agricultural Museum at Lyngby were the collection of implements and the graphs illustrating the progress of Danish agriculture.

The implements start from very primitive ploughs which were little more than pointed sticks hardened by fire and then show the gradual improvements that have been made from time to time.

The graphs illustrate the very considerable agricultural developments that have taken place during the last half century. The number of cows has been rather more than doubled and during the same period the average output of milk per cow has increased threefold. The quality of the milk has also improved, now containing four times the amount of butter fat. The average yield of milk per cow is now 7,300 lbs. containing 272 lbs. of butter fat.

The pig production has increased sevenfold, despite a large number having been killed during the war period.

Farm School.

A farm school was founded in 1887 by a number of local landowners, to give instruction in the theory of agriculture.

The farm school is run by the Director, who pays rent to the owners, and makes what profit he can from it. The school receives a state grant of approximately \$1,000 per annum and is inspected by officials of the Ministry of Agriculture.

The staff consists of five resident and eight part-time instructors. The subjects include general education, chemistry, physics, botany, bacteriology, soil management, animal husbandry, economics, testing and inspection of milk.

There is accommodation for 120 students, of whom usually 90 per cent. are farmers' sons. Students are about 20 years of age before they enter the school.

The courses all commence on the 1st November and last for nine, six and five months. There is also a special four months' course for students proceeding to the Royal Agricultural College, Copenhagen.

State Farm and Experimental Dairy.

The State Farm at Trollesminde was taken over for agricultural experiments during 1917. During 1923 a State Experimental Dairy was opened on adjoining land.

The control of each station is vested in a committee of Administration appointed by the Ministry of Agriculture.

The area of the farm is 547 hectares. The percentage of the area under each class of crop is approximately as follows:—grain 59 per cent., grass 24 per cent., roots 12 per cent., potatoes 3 per cent. and seeds 2 per cent. Grain includes areas used for cattle food. The term "seeds" in this connection denotes crops grown for the production of seed to be used as planting material and not such as clovers as the term is used in England.

The live stock consists of 389 cattle, 62 horses, 301 pigs and 968 poultry.

CATTLE. The herd consists of Jutland and Red Danish dairy cattle with some imported dairy Shorthorns.

The Jutlandish or Black and White Jutland dairy cattle are very similar to but slightly smaller than those bred in Holland and North Germany. The average yield is 7,800 lbs. of milk, containing 3.7 per cent. fat and 290 lbs. butter fat. This breed is chiefly found on the peninsula of Jutland.

Red Danish was only definitely established as a breed in 1878. It is a typical dairy animal, red or reddish brown, with a few white hairs in the switch and occasionally under the belly. The average yield is slightly better than the Jutlandish, being 8,927 lbs. of milk containing 3.8 per cent. of fat and 342 lbs. of butter fat.

Although both these breeds are primarily dairy cattle they fatten up to make a good grade of beef.

Previous to 1930, only Red Danish cattle were kept on the State Farm, but during that year, the other two breeds were introduced so that comparison of yields might be made.

Ordinary marked cows were purchased for the farm in the first instance. By the use of selected bulls and careful management and feeding during the last decade, the milk yield has been increased by over one-third, the percentage of butter fat by 0.45 and the yield of butter by two-fifths. The average yield is now, 7,600 lbs. of milk containing 3.98 per cent. fat and 382 lbs. of butter.

The main investigation with cattle at this farm is concerned with the effect of various concentrated foods on the consistency of butter. At the same time, the palatableness and digestibility of foods are recorded. This work is done in collaboration with the Experimental Dairy and results have been published.

The second important experiment is to compare the result of feeding (*a*) an excessive ration (*b*) a normal ration (*c*) an insufficient ration to heifers from birth till first calving.

PIGS. Pig keeping was not commenced till 1924 and was interrupted by a serious outbreak of disease during 1927. The main investigation is to ascertain the most economical ration which will give an increase of live weight from 45 lbs. to 200 lbs. as quickly as possible.

POULTRY. Two breeds of poultry are kept, Brown Italian and Cross-striped Plymouth Rocks. All eggs are laid in trap nests, the weight of each egg being recorded before the bird is released.

As a result of selection and controlled feeding, high-yielding strains of both breeds have been produced.

The effect of artificial light on the birds is also being recorded.

STATE DAIRY. In order to deal with all problems that arise, this institution is more fully equipped than an ordinary dairy. In addition to rooms for skimming, churning, butter packing, cream refining, cheese salting and pressing, there are chemical and bacteriological laboratories. It has its own power plant to drive the machines, cooling and lighting plants. The dairy deals with from 25 000 lbs. to 30,000 lbs. of milk daily.

The most interesting apparatus in the dairy was a "Stassaniser", invented by Dr. Stassens for pasteurising milk.

The apparatus consists of four superimposed cylinders, through which the milk is passed in tubes 1 mm. in diameter, where it is heated to 75°C. in about 20 seconds.

This process, which produces milk as pure from the bacteriological standpoint as high pasteurisation, has the following advantages:—

- (*a*) "Stassanised" milk does not differ from raw milk in taste or smell.
- (*b*) The process has no effect on the vitamins in the milk nor does it precipitate any of the albumen.
- (*c*) There is no loss by evaporation, which may amount to 1½ per cent. in the ordinary process.

Milk Supply Depot.

All the milk for the retail trade in Copenhagen is handled by the depôt. It arrives in churns, which are taken up a lift and along a roller track to the automatic weighing machines. The milk is poured into the machines by hand. The empty churns are cleansed in a large steam washer before being returned to the farms.

The milk, to be bottled as such, is run in pipes to coolers and thence to large automatic bottling machines.

Some of the milk is run through separators before cooling. The separators produce various grades of skim milk, which is all bottled. Some of the cream is bottled for sale and the balance is used in the manufacture of butter.

The empty bottles returned to the *dépôt* are washed in large steam washers and are conveyed on roller tracks to the bottling machines. During the journey an examiner removes damaged and improperly washed bottles.

The roller track conveys the bottle round the cistern of the bottling machine, where they are automatically filled with the correct amount of milk and sealed with a crown cork.

The full bottles are then conveyed to the packing shed, where they are packed in crates covered with crushed ice, which is manufactured at the *dépôt*.

Co-operation.

Co-operative societies deal with about half the agricultural business of the country, so that co-operation may be described as the keystone of the agricultural prosperity of the country.

The land owners form Mortgage Credit and Hypothec Societies when they wish to obtain mortgages on their land. The larger area being a better security, they can obtain loans at a cheaper rate. The societies issue cash bonds up to three-fifths of the value of the land against an ordinary mortgage bond. The cash bonds are dealt with on the exchange, prices being quoted daily.

The loans are redeemed by annual payments, usually over sixty years. The cash bonds are redeemed by annual drawings.

The Royal Danish Mortgage Bank, working with a state bond as its constitutional capital, takes up the mortgage bonds from the societies and issues its own cash bonds.

Co-operative societies deal with almost every phase of agricultural business. They facilitate the maintenance of the joint interests of the farmers and provide for the economies resulting from large scale production.

Each society usually strictly confines itself to its own particular business. Membership is open to any farmer and every member has an equal vote in the management of the society. The profits are divided in proportion with the individual member's turnover.

The various organisations have developed independently without intervention by government or other outside assistance. They are all members of the Union of Danish Co-operative Societies.

Co-operative slaughter houses handle 84 per cent. of the pigs killed for export. They are organised in a national union which runs a joint sales company in London.

Other societies deal with egg exporting, cattle exporting, seed supply, purchase of feeding stuffs and purchase of manures. These societies are not as strong as the two first mentioned.

In closing, the writer desires to take this opportunity of recording his personal appreciation of the hospitality extended to him while in Denmark.

DISEASES OF THE PIG*

BY

T. D. MARSH,

Assistant Agriculturist.

In a well conducted piggery very many of the diseases hereunder mentioned will never be encountered.

In the tropics cleanliness is essential to prevent the establishment of parasites both internal and external and a daily bath is strongly recommended.

The most dangerous disease in Malaya is swine fever which is briefly described. Outbreaks of this disease and swine erysipelas must be notified to the nearest Veterinary Officer.

Swine Fever.

This disease is also known as hog cholera, it is very contagious and may be introduced in contaminated food, or may be carried on the boots or clothing of persons who have been in contact with diseased animals; the infection may be transferred by blood, excrement, saliva or discharges from the eyes, nose and skin.

Symptoms. The affected animal is dull with a high temperature and quickened breathing, a red rash develops inside the thighs, on the belly and behind the ears. The rash later extends to other parts of the body; the animals often have difficulty in walking about. The acute form of the disease is very rapid and usually ends in the death of the affected animal in about three days. Cases occur which have milder symptoms, the disease develops more slowly, and in others the lungs become affected.

An outbreak of swine fever usually results in the death of all the animals in the piggery. There is no treatment; slaughtering of diseased animals and vigorous disinfection of the premises is recommended and unless the quarters are well built, so that they may be thoroughly cleaned and disinfected, it is better to move the piggery. It is not advisable to use disease polluted land for grazing pigs for several years after an outbreak. Inoculations of a serum are used as a preventative in temperate climates to immunise animals. Protection against the disease only lasts for a few days, but should inoculated pigs be affected with the disease the attack is mild and a permanent immunity in many pigs results.

Some pigs apparently can be immune and yet carry the disease without any symptoms. It is probable that such animals periodically introduce the disease into Malaya when imported for slaughter.

* The following is the second article dealing with pigs in Malaya. The first article appeared in the August number of this Journal. A further article on The Pig Farm at Serdang will be published next month.

Swine Erysipelas.

This disease is often confused with swine fever although it is stated to be quite distinct.

Symptoms. A redness of the skin behind the ears which very soon covers the whole body, afterwards turning to purple. The disease causes the death of affected animals in from one to two days.

Trichinosis.

This disease of pigs is caused by a Nematode, *Trichina spiralis*, which is a small worm that gains access to the pig's body by the animal eating flesh containing the parasites. The worms are very small and become embedded in the muscles. It is not usual for this parasite to cause much sickness in the pigs, but it is fairly common and also affects man; the safeguard against infection in man is to cook thoroughly all pork before it is eaten.

The following chart of common diseases that affect pigs is an abstract from the *Queensland Agricultural Journal* Vol. XXXVI, Part 1, of July 1931 by E. J. Shelton.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Abortion.</i> The premature birth of the foetus, due to injuries, exposure to cold, use of mouldy food; infection of the breeding organs by septic germs is also a frequent cause.	The expulsion of the foetal pigs, which is sometimes preceded by a discharge.	Comfortable and clean conditions, quiet handling and good food help to prevent abortion. Affected sow should be isolated and the uterus flooded with a solution of 20 grains of permanganate of potash to 1 gallon of water to be followed by a douche of 1 teaspoonful of salt to 1 pint of water for five days.
<i>Bronchitis</i> is an inflammation of the bronchial tubes, the actual causes being germs, worms or dust; predisposing causes are damp, dusty, and insanitary conditions.	A persistent cough and slight fever with a progressive unthrifty appearance.	Provide sanitary and comfortable accommodation, use clean bedding in cold weather, give nourishing and laxative diet, milk, green food, and a little meal. Molasses helps to keep the bowels open. One dessertspoonful of Epsom salts with equal amounts of sulphur in the molasses daily for three days for is advised.
		every 100 lb. body weight

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Indigestion.</i> A digestive disorder caused by improper feeding, coarse fibrous foods, weak washy swill, or foods in a decaying or mouldy condition.	Loss of appetite, constipation or diarrhoea; tucked up appearance in the belly.	See that troughs are clean, change the food to rectify the fault, and give in the food a dose of castor oil, 1 or 2 ozs. of oil to each 100 lb. weight of pig. Use light nourishing foods in well-balanced rations.
<i>Inflammation of the Udder.</i> A disease of the udder, caused through injuries, or through suckers not relieving the sow of her milk.	Udder is hot, hard, and painful; sow refuses to allow pigs to suck.	Remove cause when possible, apply hot water forments to udder, massage the udder, using olive oil; give 2 ozs. of castor oil in food. The massage of the udder is important. Use only light laxative foods and compel sow to take regular exercise.
<i>Intestinal Worms.</i> Several species of worms are found in stomach and intestines. Large round worms (Ascarids) are most common.	General debility, scouring, failure to make satisfactory gains in weight. The worms may be seen in the droppings and on post mortem examination.	Chief control measure is strict sanitation. Provide fresh pastures. Remove droppings and rubbish, clean troughs frequently, fill up all bog holes. Feed pigs on a laxative diet. Starve infested pigs for one day, then give in a small feed of milk half-a-teaspoonful of turpentine and 2 tablespoonfuls of castor oil for each 50 lbs. weight of pig. Repeat a fortnight later. Worm capsules may be used in the treatment of the parasites.
<i>Kidney Worms</i> are an internal parasite which gain entrance through the mouth when pigs eat from unclean troughs and floors. They affect kidneys, liver, and other organs of the body.	General debility, pig tucked up in the belly, sometimes a staggering gait, general unthriftiness of the animals and failure to make satisfactory growth.	Eggs of worms are passed out with urine and the embryos hatching from the eggs are eaten by pigs. Sanitation is the chief control measure, administration of medicine is not recommended as these worms are not removed by medicine once embedded in organs of the body. Fill up mud holes, clean troughs frequently, and provide a rotation of grazing paddocks.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Lousiness.</i> Infestation by the common hog louse (<i>Hoematopinus</i>) which is a blood sucking parasite of the skin.	Pig rubs against posts. Skin irritated and may be scurfy and sore. Lice and nits may be seen on skin and hair.	Spray or wash pigs with a mixture composed of a half-a-pint benzine, half-a-pint kerosene and 7 pints of waste oil repeat application in three days and then one week after. Apply petroleum jelly or coconut oil to the skin. Provide a rubbing post around which is wrapped a strong bag firmly fixed and soaked in oil.
<i>Mange.</i> An infection of the skin, caused by the tiny mange mite burrowing into the tissues.	Irritation and scurfing of the skin. A reddened appearance not unlike severe sunburn.	Wash pigs thoroughly with a weak solution of coal tar disinfectant, solution all wood work and floors.
<i>Necrotic Enterites.</i> A serious disease caused by a germ which affects the lining membranes of the intestine and is responsible for the resultant inflammation.	Loss of appetite, increased thirst, fever, arching of back, diarrhoea; death usually occurs in a few days.	Prevention lies in clean and comfortable quarters and good, wholesome food; isolate affected pigs, destroy those that are seriously affected. Clean up and disinfect piggery. Change food to a light nourishing diet.
<i>Paralysis of Hind-Quarters.</i> Cause often obscure and may be rheumatism, constipation, accident, kidney worms, lack of or deficiency in essential food elements.	Paralysis may be preceded by a wobbly gait and "marking time" with the hind feet, or it may be sudden. Pig eventually loses control of hind-quarters, and drags the hind legs.	Remove any visible cause; feed plenty of green food and minerals, do not overfeed with maize. Allow pigs to graze in paddocks. When pigs are affected have them slaughtered under inspection at an abattoir or bacon factory, and follow the advice given by the official carrying out the examination.
<i>Piles.</i> Protrusion of the rectum, caused through constipation and bad feeding. Overfeeding on milk products like buttermilk and whey is often responsible.	Constant straining, resulting in portion of the rectum protruding out past the anus. This is a very objectionable and serious complaint.	Isolate affected pig. Remove cause and give doses of castor oil. Wash protruding part in a weak disinfectant solution. Apply olive oil. Manipulate it back into place with the hands, reduce ration for a few days. If ration is cut down pig makes a good recovery if only 2 inches protrudes.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Pneumonia.</i> Infection of the lungs by germs following exposure to cold, damp, and draughty conditions, and other predisposing causes such as lack of nourishing food and defective sanitation.	Loss of appetite, difficult breathing, coughing, nasal discharge, fever, and is specially noted by short jerky breathing and lack of appetite.	Provide clean and comfortable accommodation and bedding in sheds in cold or wet weather. Prevent draughts on pigs when camped in shed, run pigs in lots of less than 12. Isolate affected pigs, give a light nourishing diet such as whole milk. Destroy badly affected animals. Disinfect pens and troughs.
<i>Poisoning.</i> Due to eating arsenic, common salt, and other chemical poisons. Poisonous plants and weeds are also often responsible for fatalities.	Staggering gait, vomiting, abdominal pains, diarrhoea. Death sometimes sudden, sometimes there is a lingering illness.	Find cause of poisoning and remove it. Give purge of Epsom salts or castor oil. If the poison is known, give an antidote—antidote for arsenic is the anti-arsenic drench. Send specimens of suspected poisons, plants or weeds for identification and when posting send a complete report to the Dept. of Agriculture.
<i>Rheumatism.</i> An affection of the muscles, caused through pigs lying on cold damp floors.	Intermittent lameness, swelling of joints, soreness of muscles.	Dry and comfortable sheds with a good sleeping floor; cement floors should be covered with wood. Use also clean straw bedding, particularly in cold and wet weather.
<i>Rickets.</i> A disease of the bones of young animals, due to a deficiency of essential food nutrients and to other causes such as neglected breeding.	Hard swellings at joints of bones, malformation of bones, staggering gait. Pigs affected are usually stunted and make but little headway.	Allow pigs to graze on good pasture in clean paddocks. Do not feed too much maize or other concentrated grain foods. Always include some legume crop in the ration. Give pigs a supply of mineral food, such as charcoal, ashes, bone meal, and lime. Well-balanced rations in liberal supply with plenty of clean drinking water is very necessary.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Diarrhoea, White or Yellow Scours.</i> Common in young pigs suckling the sow. Due to overfeeding, bad foods, insanitary conditions, cold draughty sties; too liberal feeding of the sow is often the predisposing cause.	Frequent discharge of watery faeces of a strong smelling characteristic odour; pigs lose condition and fall away; deaths often result.	Clean up piggery and troughs, reduce sow's food supply considerably for several days; give the sow and affected pigs a dose of castor oil and add lime water to the food. Careful feeding is essential, clean up thoroughly, disinfect sties and floors, remove to clean pens and use plenty of clean, dry bedding.
<i>Sore Mouth or Bull-Nose.</i> A disease of young pigs caused by a germ and always associated with filth.	Swellings and sores on the nose and mouth, and general unthriftiness.	Clean up piggery and troughs, and use a disinfectant; allow sunrays to get into the shed and trough. Dip the pig's nose into a solution of permanganate of potash. This solution is prejudicial to eyesight as it destroys the cement substance of the cornea.
<i>Cannibalism.—Sows eating their Young.</i> Caused through nervous excitement or the lack of some essential food element. It is sometimes hereditary and indicates a nervous temper.	Sows eat young pigs soon after they are born. It is usual for a sow to eat her afterbirth if she is permitted so to do, but it is unwise to allow her to have access to it.	Give pregnant sows good grazing, give them protein rich foods such as milk, meat meal or legumes. Handle sow quietly at farrowing time. It is usually advisable to butcher a sow that has once eaten her young. Properly balanced rations in limited supply at farrowing time is essential; correct methods of management are advised especially at this time.
<i>Tuberculosis.</i> A contagious disease caused by a germ.	Symptoms in the early stages are practically nil, in the advanced stages wasting of the body. Many pigs that are condemned show no external symptoms at all.	Pasteurise all milk product before feeding to pigs. Boil all meat before feeding to pigs. Disinfect troughs frequently, keep pigs in large, clean, and dry quarters. Destroy all pigs suspected of being tubercular. Get in touch with a Veterinary Officer immediately for advice as to how to proceed.

Abstracts.

PINEAPPLE NOTES

The Pineapple Industry in Formosa.

The area under pineapple in Formosa in the year 1931 was 12,322 acres, a decrease of 300 acres since 1930, while its export during the same year amounted to 2,008,586 dozen tins. The entire tinned pineapple industry is controlled by a series of rigid governmental regulations with which any person desirous of engaging in this industry has to conform before he can obtain permission to commence operations.

In 1930 there were eighty-three pineapple canneries in the island; there has recently been formed a Joint Sales Company, all the members of which are required to sell their produce through the Company, which, it was hoped, would then be in a position to control prices in Japan, which country absorbs over 2,000,000 dozen tins of the total output, and to eliminate wasteful competition in the purchase of fruit from the growers, while the latter were expected to benefit from the assurance of a steady market for their produce.

Variety of Pineapple for Canning.

Goods for export are manufactured chiefly from "Smooth Cayenne" from Hawaii and the "Sarawak" variety from Borneo.

It is interesting to note that the "Sarawak" pineapple is never used for canning in Malaya, it being considered too brittle in texture and too pale in colour, also the fruit is of such a shape that its cutting into "slices" for canning is a wasteful process. At the request of the Department of Agriculture, S.S. and F.M.S., samples of this variety were canned by a Singapore firm and sent to the Malayan Information Agency in London through whom trade reports on their quality were received.

In spite of the fact that a shorter period of cooking than is normal had been employed in the preparation of this fruit, in order to overcome its tendency to become "mushy", a somewhat adverse criticism was received. The first sample tin was found to be slack filled, the fruit lacking the deep yellow colour preferred in the United Kingdom in Malayan fruit, and inclining to "mushiness" owing to over-ripeness or over-cooking: its flavour although good was not very pronounced, attributed in part to the heavy syrup. The contents of the second tin opened were said to be of very poor quality, about equal to that of 2nd grade Singapore, the cubes having the whiteness of unripe pines and emitting a sour odour.

The report further states that the fruit is softer and less stringy than "Queen", adding that there is a tendency in all Malayan packings for the flavour to be somewhat obscured by the sugar as compared with Honolulu and Australian packs, where possibly a certain quantity of pineapple juice is added, which may be lacking in the Malayan product.

THE WORLD'S SUPPLY OF RICE.

A recent publication of the Empire Marketing Board* contains a valuable summary of the areas, production, exports and imports of rice throughout the world.

The total area under rice in the season 1930—31 was estimated to be 139.12 million acres, of which 60 per cent. was contained within the British Empire. (These figures exclude China). Of this total, no less than 81.99 million acres are in India.

World production in the same season is estimated at 88.38 million tons, while the average annual world production (excluding China) between 1926—31 was 85.28 million tons of rice of which 47.62 million tons is produced in the British Empire. China's production is estimated to be about 50 million tons.

India, the largest exporter in the world, exports about 5 per cent. of its crop. Foreign countries, apart from China, although producing considerably less, place a large proportion of their total crop upon external markets.

The exports of rice from the chief exporting countries (in thousand tons) in 1930 were :—Indo-China 1,009, Siam 920, Korea 688, Formosa 293, Italy 211, United States 95, Spain 56: Of Empire countries, India 2,625, British Guiana 22.

The importance of rice in export trade in certain countries is shewn by the fact that the relative value of rice exports to total exports (percentage rice to total) of India is 10 per cent., Siam 67 per cent. and Indo-China 63 per cent.

The great bulk of the surplus rice is distributed amongst neighbouring countries in the East. Of the rice exports of India, 25 per cent. go to China, 17 per cent. to Ceylon, 14 per cent. to British Malaya, 10 per cent. to Netherlands India and 14 per cent. to the United Kingdom, Poland and Germany. Of Siam's exports of white and broken white rice, 39 per cent. went to British Malaya in the 1930—31 season, 27 per cent. to Hongkong, 10 per cent. to Japan, 9 per cent. to non-British West Indies, and 8 per cent. to Netherlands India. The other large exporter, Indo-China, exported the following cleaned rice: 28 per cent. to Hongkong, 19 per cent. to China, 12 per cent. to Netherlands India, 20 per cent. to France, 4 per cent. to French Colonies and 3 per cent. to Japan.

It is seen that the imports of Ceylon and Malaya effect to a large extent the exports of India but still leave the Empire a net exporter of rather more than a million tons annually.

* Grain Crops.—A summary of figures of production and trade relating to Wheat, Wheat Flour, Barley, Oats, Maize, Rice, Rye. Empire Marketing Board 1932. H. M. Stationery Office, London W.C.2. Price 6d. Net.

Reviews.

The Cultivation and Manufacture of Tea in Ceylon and India.

E. A. Curtler, Special Bulletin, General Series No. 9 Department of Agriculture, S.S. and F.M.S. 1932. 94 pp. 10 illustrations.

Price \$1. (Straits Currency).

This publication is a summary of the information collected by the author in the course of a tour of duty to Ceylon and India, undertaken in 1930 for the purpose of acquiring the most recent information on the subject of tea cultivation and manufacture as practised in these countries.

The bulletin is in two parts, the first dealing with the cultivation of tea in Ceylon and India and the second with the manufacture of tea in these two countries.

While the cultivation and manufacture of tea follow the same general principals in all countries yet the procedure varies according to climatic and other conditions. Frequently such variations are noted between adjoining estates. It follows therefore, that no account on this subject can cover or be applicable in detail to the cultivation or manufacture of tea in any other place. The author emphasises this point and recommends that very detailed records be kept of all work in field and factory so that the correct procedure may be ascertained and any seasonal variations adversely affecting the quality of the produce may be countered both in the field and the factory.

Most readers will be aware of the general cultural methods which form an integral part of the cultivation of any tropical crop. One's experience, for instance, and the literature now available on methods of preventing soil erosion make a very detailed account of this subject unnecessary in a publication of this nature. On the other hand, methods of cultivation peculiar to the crop under discussion merit closer attention, while on such subjects as manuring, pruning and plucking, the reader will desire full particulars concerning modern methods which are the outcome of many years of estate practice.

The author maintains a correct balance in his treatment of the various stages in the establishment of a tea plantation, bearing in mind that he writes, not for the general agriculturist or for the tourist, but rather for the experienced planter who particularly looks for details of modern methods of treating this crop. It is thus seen that in this account, while soil erosion is given but one page, cover crops three, drainage less than three, yet prominence is given to such subjects as manuring, pruning and plucking.

Throughout the bulletin, frequent comparisons are made between methods employed in Ceylon and India. The indications of the reasons for such variations will assist the reader in the application of the principles involved to the conditions peculiar to the site where he may propose to cultivate this crop.

The reader of the Special Bulletin will recognise that with all the knowledge that he may acquire on tea estates in other countries, and by reading literature on the subject, ultimate success in a new environment will depend

upon a quick appreciation of local characteristics which affect the product and a realisation of the extent to which he can introduce innovations applicable to local conditions.

It is probable that Mr. Curtler's account will satisfy the growing demand in Malaya for the most recent information on tea production in neighbouring countries especially in view of the increased attention that is being given to this crop in the Highlands of this country. The additional fact that the author is stationed at Cameron Highlands should be of value to those developing tea plantations in this area.

D. H. G.

Oil Palm Products.

Survey of Vegetable Oilseeds and Oils Vol. I Oil Palm Products. Empire Marketing Board. 130 pp. Illustrated. H.M. Stationery Office, June 1932. Price 1s. net, postage extra.

Those who have invested capital in the development of oil palms estates and also prospective investors in the industry have for some time past desired a publication which would give in detail, information on the production of palm oil and kernels in other countries, the markets for these raw products and the uses to which they were applied. With such information the capitalist and planter would be in a better position to envisage the future of the industry and thus be enabled to decide as to the prospects of further development in the production of the high quality palm oil which is obtainable under the plantation system.

The recent volume compiled by the Empire Marketing Board will be found to fulfil the wishes of the investor in these respects. In the course of their investigations the Board found difficulties in estimating the degree of substitution of competing oils used in certain important industries. In consequence, the reader is promised a further volume from the same source which will carry these investigations to more definite conclusions than are possible by consideration of this one product.

The present volume, however, in four chapters, gives a complete survey, country by country, of the production and export of palm oil and kernels, the principal markets to which each are sent and the fluctuations of price from year to year.

The exports of both palm oil and kernels increased considerably in post-war years. The average annual exports of kernels over the period 1909—13 was 317,044 tons and of palm oil 121,906 tons, while the 1930 exports were 554,468 tons and 272,661 tons respectively.

Bearing in mind that the palm under plantation conditions, yields about 16 cwts. of palm oil to 4 cwts. of kernels, one is struck by the relatively small quantity of palm oil which is exported in comparison with the large amount of kernels which find their way to the world's markets. The apparent discrepancy is explained by an investigation of conditions of production in the chief African

producing areas from which source 189,400 tons of oil is exported, whereas based on a fruit content of 13 per cent. palm kernels and 22 per cent. palm oil, the potential production of palm oil is 712,000 tons. The balance of the 712,000 tons is put down as domestic consumption, waste and residue impossible of extraction.

The potential export of this large quantity of palm oil from East Africa is a subject of very grave importance to producers of the plantation product, for the latter must feel that at some time or other, and especially if a period of better prices is realised, a sudden increase in exports of native-produced oil from Africa may result. The greatest potential producer is Nigeria. In discussing this question in Nigeria, we are told,

"Palm oil is largely used by the natives for cooking purposes and as an illuminant, and the kernels are regarded by them as a bank to be drawn upon in times of need. Hence a period of low prices will result in a material decrease in output both of kernels and of palm oil, owing to the lack of sufficient inducement to undertake the labour of harvesting and preparing larger supplies than are needed for home consumption; at such times only part of the crop is harvested, the rest being left to rot on the trees".

Efforts have been directed by educational methods to increase production and improve quality, and while some success has been achieved, it is stated that progress must necessarily be slow. Almost the whole of the Nigerian exports of palm oil are the product of native labour, the oil being extracted by slow and wasteful methods. The few small factory mills which have been established have not proved very satisfactory owing to opposition of the small traders, irregularity of supply and difficulty of transport of the fruit.

At present, improvements are directed in the following channels (*a*) thinning and re-planting in natural palmeries, (*b*) subsidies to erectors of small mills, (*c*) bulk handling of oil at ports and (*d*) Government supervision and inspection with a view to improvement of quality and grading of the product.

Efforts are being made in the British possessions and also in the important French, Belgian and Portuguese colonies in Africa to increase the export and improve the quality of palm oil, the methods used depending upon the particular aspects of the problem which apply in each instance. Ultimately, these efforts must result in improvements in the directions desired, although at the moment they have but little visible effect on the exports.

It appears probable that provided the price of palm oil reaches no abnormally high level, and that there is a satisfactory extension of the market, there is little danger of the African product swamping the market and thereby rendering the plantation production unremunerative.

Such provisos necessarily direct our attention to present markets and possibilities of future extension of the market.

Palm oil finds its chief uses in soap making, the tin plate industry, margarine and edible oils. Palm oil is an important constituent in the manufacture of

soap, but substitutes, such as whale oil, are now largely employed in this connection. The utilisation of palm oil in this industry is thus largely a question of price in competition with substitute oils. It is held, however, that palm oil still finds its principal outlet in the manufacture of soap. In this connection it is pointed out that the increased import of palm oil into America (from an average of 27,000 tons per annum between the years 1909—13, to 128,000 tons in 1930) was coincident with an increase in the production of soap in that country.

In the tinplate industry, palm oil has been found to give the best results in the so-called "pickling" process of manufacture, but there appear to be no very considerable extensions probable in this direction.

The amount of palm oil used in the manufacture of margarine and edible fats is small. The publication gives no reason for this fact, and in view of the suitability of high quality palm oil for such purposes, it is probable that this industry provides the most promising outlet for the oil produced from plantations in Malaya and Netherlands India.

The publication, after noting the decline in the candle industry, states that a new field for palm oil may be provided by its utilisation as a fuel for Diesel and semi-Diesel engines.

"Experiments have been attended with some success but no commercial development has ensued where other fuels are available at low cost. In the Belgian Congo, where petrol is relatively dear, palm oil has been successfully substituted for utilisation in special motors, and much satisfaction has been evinced at the results obtained in the case of heavy transport vehicles. Not only has the cost of transport been thereby substantially reduced but the inconvenience attaching to the use of highly volatile fuels in countries of high temperature has been obviated. As yet, this form of utilisation is still largely in an experimental stage and has no great commercial importance. Its potentialities should, nevertheless, not be overlooked, and it may possibly provide in the near future an important outlet for palm oil consumption."

The reader is referred to the original publication for much valuable information on palm kernels and on the reasons for the fluctuations in price of the two products of the oil palm. We are chiefly concerned with the possibilities of the Malayan product. The future is necessarily somewhat uncertain, but there appears every reason to assume that edible oils have an important future, and it is as an edible oil that we consider that the plantation product will hold its own by reason of its purity and price in comparison with its competitors. One of the main reasons for this contention is that with such a product as palm oil the manufacturer can be sure of future supplies at steady prices whereas with many of its competitors—which are annual crops—production and consequently price, depend largely on seasons.

The Empire Marketing Board concludes this first volume in the following words :—

"The cultivation of the oil palm will no doubt continue to expand steadily as the new areas in British Malaya and the Dutch East Indies are brought into full bearing and as improved methods of cultivation and harvesting materialise in the older areas in West and Central Africa. The future supplies of oil palm fruit are therefore assured and the outlook for the industry will depend mainly upon the growth of demand for palm kernel oil and palm oil. The demand for these products in turn mainly depends on the one hand on the growth of the soap and candle and of the margarine and other edible fat industries and on the other hand on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

"The expansion of these industries, more particularly that of soap, should continue with the general increase in population and with the continued rise in the standard of living. As regards the substitution of one fat for another in these industries the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. But price considerations also play an important part and over a relatively short period the price factor is probably the more potent. In this connection the efforts that are being made to improve the productivity of the oil palms and to increase the oil content of the fruit should result in a lowering of the cost of the product, while the increasing importance of factory production which now accounts for about 25 per cent. of the volume of palm oil entering world trade as compared with less than 5 per cent. in 1920 should also tend in the same direction. But it remains to be seen whether the reduction will be sufficient to permit of more effective competition with other oils and fats such as coconut oil, groundnut oil, cottonseed oil and whale oil, which are the principal oils entering into competition with the products of the oil palm."

D. H. G.

Malayan Rubber Statistics Handbook, 1932.

*Compiled by the Department of Statistics S.S. and F.M.S. Government
Printing Office, Singapore. Price \$1.50 (Straits Currency)
post free.*

The title of this publication is somewhat misleading as it infers that the information contained therein concerns 1932 rubber statistics, whereas in point of fact it is a record of Malayan acreage planted annually with rubber trees to the end of 1931 and of Malayan statistics of production, imports, exports and consumption of rubber for the year 1931.

The publication has been extended somewhat from the previous edition by the inclusion of statistics relating to ownership of rubber estates, production rates, average areas out of tapping, average market price of rubber and a graph

of daily market prices of rubber in 1931. Certain other tables give greater detail than did the corresponding tables in former editions.

The Handbook is a most useful compendium of statistical information on the Malayan rubber producing industry.

D. H. G.

Coffee.

Nineteenth Report of the Imperial Economic Committee. H. M. Stationery Office, London, 1931. 6d. net plus postage.

The cultivator of primary products to-day must be something more than one who can coerce a good harvest from the soil. Especially in times like the present, when the margin between profit and loss is narrow, businesslike methods of costings are essential.

Furthermore, the producer must study the world demand respecting grade and quality, and in this matter he may find guidance from the constant flow of inexpensive literature published by various public bodies.

The Imperial Economic Committee has already published nineteen reports, twelve of which deal with the preparation for market and marketing of food-stuffs and raw materials produced within the Empire.

Coffee, the latest report of the series, deals adequately with the subject, giving special emphasis on the effect of increased production on different grades of coffee, cultivation and preparation, coffee producing areas in the British Empire, research, evaluation and marketing methods, besides a number of factors to be taken into consideration in order to judge of future prospects of the industry. The twenty-six tables and one chart which form the Appendix to the Report give all the essential data regarding production, consumption and prices. The reader is even told how to prepare the beverage.

It is not proposed in this place to give a detailed review of this publication. To do so would be to reproduce most of the 68 pages of the Report, for the publication in itself is a condensed statement of the subject. It is, however, suggested that agriculturists should make a close study of this most readable report before embarking on any new coffee project, so that they may be cognizant of the demands of the consumers in different parts of the world, which are necessarily reflected on the grades recognised by the Trade.

D. H. G.

Departmental. FROM THE DISTRICTS.

The Weather.

In general, the first half of August was dry and the second half wet. In Kelantan, Province Wellesley, and the coastal parts of Malacca, the rainfall did not commence until the end of the month. In Kedah and Pahang the whole month was fairly dry, especially on the East coast of Pahang, as it was also in the Tampin District of Negri Sembilan. In the northern half of Perak, with the exception of Krian District, the weather was wet, especially in the second half of the month. In Singapore island though the rainfall was low, conditions were damp and cool.

Remarks on Crops.

Rubber.—There was a further well marked rise in the price of rubber during August. Smoked sheet from small-holdings sold for \$5.00—\$11.00, unsmoked sheet for \$4.40—\$9.00, and scrap for \$1.00—\$5.50 per pikul. In Singapore the corresponding prices were \$9.20, \$7.70 and \$3.00 per pikul.

Owing to this rise in price tapping was again commenced on a number of holdings on which it had been discontinued for some time. This was particularly noticeable in the Settlement of Penang, Southern Perak and Pahang. As a general rule, however, holdings owned by Malays were not retapped in areas where padi planting work was in progress, while in Selangor and parts of Johore the rise in price did not restore confidence in rubber, though if it is continued, retapping will undoubtedly become more general.

Recent hot dry weather caused a heavy secondary wintering during the month in the States of Pahang and the Negri Sembilan. In the latter a fairly general but mild attack of leaf mildew, *Oidium Heveae*, occurred on the young foliage.

Mouldy Rot was in evidence in areas where the weather was wet and proved difficult to control owing to the inability of many owners of small holdings to provide the purchase price of even the cheapest disinfectants.

Padi.—The price of padi remained unchanged, ranging between 6½ and 15 cents per gantang in different parts of the country. The work of preparing the land and transplanting from the nurseries was delayed by dry weather in parts of Kelantan, the whole of Province Wellesley and the coastal portions of Malacca, as well as in the coastal portion of Krian District where a heavy growth of weeds in the canals had impeded the flow of the water. Drought also checked growth of the padi in the country bordering on the Pahang river.

Leptocorisa acuta, the padi fly, and birds did a little damage to the flowering inter-season crop in Selangor, but on the whole a good yield was anticipated.

In one of the two localities in the Dindings the co-operative construction of a bund by local padi growers was nearing a successful completion, but in the other the Malays lost interest and discontinued the work. In Province

Wellesley a bund was successfully repaired and increased in height by similar co-operative work.

In Malacca a further 275 gantangs of seed of pure strain padi brought the total distributed up to 3,200 gantangs. In Kedah 1,017 gantangs of selected seed were distributed in exchange for local mixed padi, while a further amount of 125 gantangs was distributed in Province Wellesley.

Coconuts.—Malays in the Settlement of Penang evinced an interest in the preparation of copra and sought advice on the construction of the improved type of kiln. This movement was a direct outcome of the visit of the Rural Lecture Caravan.

A movement in the same direction was initiated by the Principal Agricultural Officer, Johore, in the Batu Pahat District where a well attended meeting of the leading Malay owners of coconut holdings was held towards the end of the month.

In Selangor there was a steady improvement in the quality of the copra produced by Malays and several additional kilns were constructed. This development has attracted the attention of certain large buyers who are offering improved prices if copra of good quality is forthcoming in sufficient quantity. Progress in copra manufacture by the Malays of Bagan Datoh District was also recorded together with a rise in price.

A number of Malays in Kuala Langat District of Selangor have commenced preparing their own coconut oil which they sell at the local fairs for 13—14 cents per quart bottle. Oil is also made locally in the Pekan and Kuantan Districts of Pahang and sells at prices varying from 12—20 cents per bottle.

One Malay in Kuala Selangor District is manufacturing soap from coconut oil which he makes from his own nuts. The quality is, however, poor at present owing to faulty manufacture; advice on improving it has been given.

Small but severe outbreaks of the caterpillar pest *Artona catoxantha* were found at Siputeh in Kinta District and Sungei Buya in Kuala Langat District.

Although there have been local improvements in the price of small-holders' copra, the general range of prices was the same as in July, namely \$3.80—\$5.50 except for copra of the worst quality which realised as little as \$3.00 per picul.

Tobacco.—Interest in this crop is well maintained and a number of small plots are continuously being planted in all parts of the country. The Chinese gardeners practise a rotation of crops, following tobacco with beans and then root crops, ground nuts or vegetables. In consequence, the area planted by them varies considerably.

An area of 200 acres in Perak North and another of 105 acres in Johore are being planted for production on a larger scale.

Prices for the better quality leaf ranged from \$20 to \$40 per picul, except in Pahang where they were \$30 to \$64 per picul. Second quality leaf sold for \$7 to \$20 per picul and cut tobacco from 50 to 96 cents per kati generally and up to \$1.20 per kati in Pahang.

Pincapples.—As supplies of fruit were no longer available most factories temporarily ceased working.

Two large areas aggregating 5,200 acres were being planted with pineapples as a sole crop in Johore where a further 5,000 acres for the same purpose were recently alienated.

Fruit.—The season for local tree fruits terminated at the end of the month after good crops of langsats, rambais and dukus had been obtained in Province Wellesley, Jack fruit and rambai in North Perak and of duku in Johore.

In Selangor durians and rambutans were flowering and in Pahang East mangoes and pulasans.

Cloves.—Clove trees in Penang Island were coming into bearing and showed promise of a good crop. Existing trees were mulched and a considerable number of young seedlings were planted.

Agricultural Stations and Padi Test Plots.

KELANTAN. *Pasir Puteh Padi Experiment Station.*—At this wet padi Station sixteen varieties are being tested in replicated plots, while a manurial experiment has also been commenced. The Station suffered from drought to an extent which rendered cultivation impossible, but this difficulty was overcome by installing an engine and pump to deliver water from a roadside drain.

Kota Bharu Experiment Station.—At this Station varieties of dry padi are under trial. Weeding and mulching were carried out. In spite of lack of rain all varieties made good growth.

PERAK. *Kuala Kangsar Agricultural Station.*—A crop of Virginia tobacco was harvested. It was found that plants which had been grown under the shade of cheese-cloth did not show any superiority in growth and leaf texture over the unshaded plants. The crop suffered badly from Wilt Disease, *Bacterium solanacearum*, which is prevalent in the soil of this Station. A fair crop of maize was also harvested.

SELANGOR. *Panchong Pedena Padi Test Station.*—The jungle on this new Station was felled and burnt. Stumping and clearing were in progress. Similar work was undertaken on a site for a small subsidiary demonstration and test plot at Sungei Derani in another part of this new padi area.

Work on other Stations and Plots proceeded normally.

Village fairs were started in 12 new centres during the month. These included one in Malacca where such fairs have not previously been held. These fairs not only enable local growers to dispose of the produce of their land at reasonable prices, but they also encourage village industries as is shown by the fact that baskets from Port Dickson together with walking sticks and tables made by Malays were sold at the Batu Gajah fair.

Demonstrations.

On August 31st a demonstration was given at the Cheras Agricultural Station in Selangor to 46 Malay headmen from the Klang and Kuala Langat Districts. Special attention was paid to the method adopted for opening up hilly land with a view to preventing soil wash. The interest evinced in manuring and the different varieties of cover crops was encouraging, especially at a time when a number of vegetable gardens are being formed on old rubber land.

DEPARTMENTAL NOTES.

The Director of Agriculture visits Labuan and Brunei.

Dr. H. A. Tempany, Director of Agriculture, S.S. and F.M.S., visited Labuan and Brunei between August 12th. and 30th., 1932.

The tour was made with the object of reviewing the condition of agriculture in these places and advising the Governments concerned on the development of agricultural services in these two administrative units.

Clove Trade Mission.

A Clove Trade Mission from Zanzibar, consisting of two members, Mr. G. D. Kirsopp, Comptroller of Customs, Zanzibar and Mr. C. A. Bartlett, visited Penang on August 18th. and 19th. and the Government Experimental Plantation, Serdang on August 21st. In Penang, the members of the Mission inspected a few clove plantations under the guidance of the Agricultural Field Officer, Province Wellesley and Penang and were introduced to the leading importers and exporters of cloves.

School of Agriculture, Malaya.

The School term ended on 13th. August. Next term begins on 13th. September.

A three week's special course of training for Assistant Penghulus commenced at the School on 15th. August. Sixteen Penghulus, representing all States of the Federation, are taking the course.

Parties of Penghulus from Kedah, Krian and other centres visited the School on 31st. July and 1st. August. Amongst other visitors to the School were the Hon'ble Mr. A. S. Haynes, British Adviser, Kelantan on 19th. August, and the Hon'ble Dr. N. L. Clarke of Malacca on 1st. August.

Leave.

Mr. R. A. Altson, Assistant Mycologist, has been granted 8 months and 17 days leave on full pay from 17th. August, 1932.

Statistical.

MARKET PRICES.

August 1932.

Rubber.—The price of rubber has gradually improved during the month, in Singapore from 6 cents at the beginning of the month to 9½ cents at the end of the month, the latter being the highest price recorded since early in January. The average Singapore spot price of rubber smoked sheet equal to London Standard in August was 7.41 cents per lb. as compared with 5.39 cents in July. The average London quotation was 2.44d. per lb., and New York 3.56 gold cents per lb. as compared with 1.77d. and 2.30 cents respectively in July.

Palm Oil.—The following cabled quotations per ton are c.i.f. Liverpool on a basis of 18 per cent. f.f.a. August 4th. £15.15.0, 11th. £16.5.0, 18th. £17.5.0, 25th. £17.10.0. The market has for the most part been steady and closed the month quiet.

Copra.—The Singapore market has continued steady during the month, while a good volume of business continues to be done. Average Singapore prices per picul during August were:—Sundried \$5.55, Mixed \$5.04, as compared with \$5.40 and \$4.96 respectively in July.

Coffee.—Singapore prices have improved during the month: Palembang coffec averaging \$17.25 per picul, as compared with an average price of \$16.15 in July; and Sourabaya coffee averaging from \$22.37 to \$24.01 per picul—the price within these limits depending upon quality. The average price of Sourabaya coffee in July was \$20.06 to \$23.05 per picul.

Arccanuts.—Palembangs were steady around \$3 per picul, the average price in Singapore during August being \$3.02 per picul. Bila Whole was steady at \$3.25 as compared with \$3.35 in July. Average Singapore prices per picul for other grades in August were:—Split, \$5.00 to \$7.40; Red Whole, \$6.19 to \$7.25; Sliced, \$9.50 to \$11.25; Kelantan Splits, \$7.20 to \$7.65.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during July 1932:—Siam No. 2 ordinary \$3.96; Rangoon No. 1, \$3.73, as compared with \$3.89 and \$3.88 respectively in June.

The average retail market prices in cents per gantang of No. 2 Siam rice in July were:—Singapore 28, Penang 33, Malacca 28, as compared with 29, 36 and 27 respectively in June.

Gambier.—Block gambier was quoted throughout the month in Singapore at \$6 per picul. Cube No. 1 dropped 50 cents to \$11.50, the average price for August being \$11.62 per picul. Average prices in July were \$6.31 and \$12.50 respectively.

Pineapples.—Singapore prices have been somewhat easier. At the end of the month a certain amount of buying was done for Canada. Average Singapore prices per case during August were:—1½ lb. cubes, \$3.06, 1½ lb. sliced flat \$3.32, 1½ lb. sliced tall \$3.42, as compared with \$3.07, \$3.32 and \$3.41 respectively in July.

Tapioca.—Market quiet. Average Singapore quotations per picul in August were:—Flake, fair \$3.15; Pearl, seed \$3.87; Pearl, medium \$4.00, corresponding prices in July being \$3.20, \$3.85, and \$4.

Sago.—Prices advanced early in the month owing to steady demand from European and Eastern markets, which slacked off towards the end of the month. Average Singapore prices per picul in August were:—Pearl, small fair \$4.25, this also being the average price in the previous month, and Flour, Sarawak, fair \$2.05 as compared with \$1.97 in July.

Mace and Nutmegs.—Stocks are slight, and prices steady, but the demand generally has been slow. The average Singapore prices per picul for mace in August were:—Siouw \$48.25, Amboina \$34.75, as compared with \$53.25 and \$34.75 in July.

Nutmegs 110 per lb. averaged \$22.50 per picul, and 80 per lb. \$29.50 per picul, as compared with \$23.50 and \$31.25 respectively in July.

Pepper.—Prices of white pepper improved over those ruling at the end of July, but there was little interest in Singapore Black, until the end of the month when the price of this grade improved slightly in sympathy with that of white. Average Singapore prices per picul in August were:—Singapore Black, \$18.06, Singapore White, \$24.19, Muntok White, \$24.65, as compared with \$18.44, \$24.31 and \$24.87 respectively in July.

Cloves.—Singapore stocks are light and prices have been steady. The average price of Zanzibar was \$40.25 and of Amboina \$42.25 per picul, as compared with nominal prices of \$43 and \$45 respectively in July.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Weekly Reports published in August. Palm oil reports are kindly supplied by Messrs. Cumberbatch and Co., Ltd., Kuala Lumpur, and reports on the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57 Charing Cross, London, S.W.1.

ERRATUM: *Malayan Agricultural Journal*, Vol. XX, No. 8, August 1932 page 435 line 4 up: *Pincapples* "1½ lb. sliced tall \$3.06" should read "1½ lb. sliced tall \$3.41".

GENERAL RICE SUMMARY*

July, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during July, 1932, amounted to 50,008 tons as compared with 60,331 tons in July, 1931, of which 54.2 per cent. were consigned to Singapore, 18.5 per cent. to Penang, 5.6 per cent. to Malacca, 15.2 per cent. to the Federated Malay States, and 6.5 per cent. to the Unfederated Malay States.

Of these imports 61.0 per cent. were from Siam, 37.1 per cent. from Burma, 0.7 per cent. from French Indo-China and 1.2 per cent. from Other Countries.

Total foreign exports of rice in July, 1932, were 13,924 tons (including 174 tons domestic production, exported from Penang) as compared with 14,345 tons in July, 1931. Of these exports 87.2 per cent. went to Netherlands India and 12.8 per cent. to Other Countries.

Net imports for the period January to July, 1932, were 235,566 tons as compared with 308,196 tons for the same period of 1931, a fall of 23.6 per cent.

The padi reports indicate that work for the season 1932—33 is in hand in all areas.

India.—Total foreign exports of Rice (*Indian Trade Journal* 4.8.32) during June, 1932, were 182,000 tons as compared with 239,000 tons in May, 1932, and 198,000 tons in June, 1931, decreases of 23.8 per cent. in respect of the previous month and 8.1 per cent. in respect of the same period of the previous year.

Total exports during the period January to June, 1932, were 1,418,000 tons as compared with 1,246,000 tons, for the corresponding period of 1931, an increase of 172,000 tons or 13.8 per cent.

Total exports of rice and bran from Burma for the period January 1 to July 2, 1932, amounted to 1,964,347 tons as compared with 2,237,337 tons for the corresponding period of 1931 or a decrease of 12.2 per cent. Of these exports 505,448 tons went to India in 1932 as compared with 939,440 tons in 1931, a decrease of 46.2 per cent.

Japan.—The *Trans-Pacific Journal* dated July 21, 1932, states that according to the Ministry of Agriculture and Forestry, stocks of rice in Japan (Proper) on July 1 amounted to 3,337,360 tons being 329,130 tons or 9 per cent. less than the figure for the same period of last year.

A review of the position from July 1 to the end of October 1932 shows that there is an anticipated balance of rice on November 1 (the beginning of the new season) of 759,510 tons. This includes probable imports from Korea and Formosa.

* Abridged from the Rice Summary for July 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Formosa.—An official communication from H.B.M. Consul, Tamsui, dated July 2, 1932, states that the area under rice during the first crop of 1932 was 699,998 acres or 22,554 acres more than the corresponding crop last year. The estimated production is 562,000 tons being 53,182 tons or 10.5 per cent. more than the corresponding crop of 1931.

Korea.—The *International Crop Report, Rome*, for July 1932, states that the 1931—32 crop is estimated at 4,105,000 acres and 2,825,200 tons of rice as compared with 3,970,000 acres and 3,426,170 tons in 1930—31, an increase of 3.4 per cent. in acreage and a decrease of 17.5 per cent. in production.

Siam.—Exports (approximate) of rice from Bangkok during June, 1932, amounted to 130,564 tons as compared with 87,741 tons in June, 1931, or an increase of 48.8 per cent.

Exports of rice from Bangkok during the period December 1931, to June 1932, (the figures for June 1932 being preliminary) amounted to 879,763 tons an increase of 141,522 tons or 19.4 per cent. as compared with the same period of 1930—31.

Netherlands India.—*Java and Madura*. The *Korte Berichten* of July 29, 1932, states that at the end of June, 1932, the area harvested amounted to 6,949,250 acres, an increase of 220,500 acres or 3.3 per cent. as compared with the same period of 1931, the area damaged to 272,345 acres a decrease of 88,158 acres or 24.5 per cent. as compared with 1931 and additional plantings awaiting harvest to 1,781,500 acres an increase of 89,250 acres as compared with 1931, a total of 9,003,095 acres as compared with 8,781,503 acres for the same period of 1931, an increase of 2.5 per cent.

Imports of rice into Java and Madura during January to June, 1931, totalled 95,723 tons as compared with 153,943 tons for the same period of 1931 or a fall of 37.8 per cent.

Imports of rice into Outer Provinces during January to May, 1932, totalled 105,150 tons as compared with 144,331 tons for the same period of 1931 or a fall of 27.8 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932 to July 31, 1932, amounted to 724,857 (metric) tons, an increase of 12,056 tons or 1.7 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to July 31, 1932, amounted to 734,793 (metric) tons an increase of 84,076 tons or 12.9 per cent. as compared with the same period of 1931.

The *International Crop Report, Rome*, for July, 1932, states that the total production of Indo-China for the season 1931—1932 amounted to 5,621,300 tons as compared with 5,788,300 tons for the previous season, or a fall of 2.9 per cent.

Ceylon.—Imports for 6 months to June 30, 1932, were 231,712 tons, an increase of 19,721 tons or 9.3 per cent. as compared with 1931.

Of these imports, 20.0 per cent. was from British India, 68.3 per cent. from Burma, .3 per cent. from the Straits Settlements and 11.4 per cent. from Other Countries (Cochin-China, Siam, etc.).

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe, period January 1 to July 21, 1932, 603,595 tons as compared with 741,542 tons for the same period of 1931, a decrease of 18.6 per cent. Of the 1932 shipments 60.5 per cent. was from Burma, nil from Japan, 32.3 per cent. from Saigon, 3.3 per cent. from Siam and 3.9 per cent. from Bengal, as compared with 68.3 per cent. from Burma, 1.9 per cent. from Japan, 20.1 per cent. from Saigon, 6.5 per cent. from Siam and 3.2 per cent. from Bengal in 1931.
- (b) To the Levant, period January 1 to June 21, 1932, 40,565 tons, an increase of 16,125 tons or 66.0 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to June 18, 1932, 69,909 tons, a decrease of 32,181 tons or 31.5 per cent. as compared with the same period of 1931.

MALAYAN AGRICULTURAL EXPORTS, JUNE, 1932.

Product.	Net Exports in Tons.				
	Year 1931	Jan. to June 1931	Jan. to June 1932	June 1931	June 1932
Arecanuts ...	19,266	11,247	13,481	3,162	2,861
Coconuts, fresh ...	10,468	3,803	63,787*	744	9,578*
Coconut oil ...	9,909	4,957	5,187	851	925
Copra ...	100,809	41,126	37,054	6,999	8,486
Gambier, all kinds ...	2,563	1,240	1,502	210	224
Palm kernels ...	726	282	526	16	40
Palm oil ...	4,574	1,825	3,176	361	425
Pineapples, canned ...	59,457	34,833	37,202	7,667	6,137
Rubber (production) ...	434,857	211,055	200,321	35,687	30,701
Sago,—flour ...	5,608	1,539	5,188	364	1,072
„ —pearl ...	2,429	907	1,228	153	102
„ —raw ...	2,904†	1,286†	2,080†	65†	619†
Tapioca,—flesh ...	9,742	4,997	4,521	996	595
„ —flour ...	491†	69	163†	40†	87†
„ —pearl ...	19,006	9,354	10,448	1,976	1,964
Tuba root ...	74	32	50	7	$\frac{1}{2}$

*'100 in number

† Net imports.

AREA OF RUBBER OUT OF TAPPING IN NETHERLANDS INDIA.

	A Totally Ceased		B Partly Ceased		Total A & B.	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
JANUARY						
Java and Madoera ...	165	75,928	63	18,372	228	94,300
Outer Provinces ...	148	47,461	70	26,567	218	74,028
Netherlands India	313	123,389	133	44,939	446	168,328
FEBRUARY						
Java and Madoera ...	110	38,393	52	12,409	162	50,802
Outer Provinces ...	102	30,999	69	30,739	171	61,738
Government ...	—	—	—	2,416	—	2,416
Netherlands India	212	69,392	121	45,564	333	114,956
MARCH						
Java and Madoera ...	123	43,586	60	13,768	183	57,354
Outer Provinces ...	133	38,045	70	26,093	203	64,138
Netherlands India	256	81,631	130	39,861	386	121,492
APRIL						
Java and Madoera ...	165	75,928	63	18,372	228	94,300
Outer Provinces ...	148	47,461	70	26,567	218	74,028
Netherlands India	313	123,389	133	44,939	446	168,328
MAY						
Java and Madoera ...	198	109,984	59	19,431	257	129,415
Outer Provinces ...	185	64,459	72	28,319	257	92,778
Netherlands India	383	174,443	131	47,750	514	222,193
JUNE						
Java and Madoera ...	219	126,363	51	17,109	270	143,472
Outer Provinces ...	200	83,849	64	28,474	264	112,323
Netherlands India	419	210,212	115	45,583	534	255,795

Total area for January amounts to 10% of the total tappable area as at the end of Dec. 1931.

- do -	February	- do -	12%	- do -	- do -
- do -	March	- do -	13%	- do -	- do -
- do -	April	- do -	18%	- do -	- do -
- do -	May	- do -	24%	- do -	- do -
- do -	June	- do -	27%	- do -	- do -

Abstracted from *Korte Berichten*.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF JULY, 1932.

STATE OR TERRITORY (1)	Acreage of Tappable Rubber end 1931 (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	238,420	18,856	7.9	30,054	12.6	48,910	20.5
Selangor	294,030	24,330	8.3	36,499	12.4	60,829	20.7
Negri Sembilan	217,002	21,965	10.1	23,173	10.7	45,138	20.8
Pahang	35,122	7,547	21.5	4,778	13.6	12,325	35.1
Total F.M.S. ...	784,574	72,698	9.3	94,504	12.0	167,202	21.3
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	3,605	8.2	8,132	18.5	11,737	26.6
Dindings	6,700	884	13.2	1,027	15.3	1,911	28.5
Malacca	110,288	6,103	5.5	22,893	20.8	28,996	26.3
Penang Island	1,585	1,058	66.8	84	5.3	1,142	72.1
Singapore Island	28,033	14,058	50.1	3,741	13.3	17,799	63.5
Total S.S. ...	190,661	25,708	13.5	35,877	18.8	61,585	32.3
UNFEDERATED MALAY STATES :—							
Johore	313,385	45,900	14.6	33,300	10.6	79,200	25.3
Kedah (a)	114,254	9,638	8.4	4,616	4.0	14,254	12.5
Kelantan	16,785	6,184	36.8	1,590	9.5	7,774	46.3
Trengganu (b)	4,300	nil	nil	nil	nil	nil	nil
Perlis	903	177	19.6	426	47.2	603	66.8
Total U.M.S. ...	449,627	61,899	13.8	39,932	8.9	101,831	22.6
Total MALAYA ...	1,424,802	160,305	11.3	170,313	12.0	330,618	23.2

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

The above table was prepared by the Statistics Department, S.S. and F.M.S.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1932.

AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE									
Means of				Absolute Extremes				At I		At 4		Number of days			Total		Daily Mean		Per cent	
A.		B.		Mean of A and B		Max.	Min.	Lowest	Lowest	Max.	Highest	Precipitation .01 in or more		Thunder-storm	Fog morning obs.	Gale force 8 or more	hr.	in.	hr.	%
°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	Amt.	in.	mm.	in.	mm.	in.	%
Railway Hill, Kuala Lumpur, Selangor	90.7	71.2	80.9	95	74	83.6	84.6	9	8	2	1						178.75	5.77	47	
Bukit Jeram, Selangor	88.1	72.4	80.3	92	74	84.4	86.6	11	8								216.90	7.00	57	
Sitiawan, Perak	90.6	72.3	81.5	94	75	84.3	85.0	9	7	1							209.85	6.77	55	
Kroh, Perak	85.6	69.2	77.4	88	72	81.9	82.6	12	10	1							170.95	5.51	45	
Temerloh, Pahang	88.7	71.7	80.2	93	74	84.9	85.3	7	7	1	14						166.55	5.37	44	
Kuala Lipis, Pahang	88.5	71.5	80.0	91	75	83.7	84.4	8	8	20							174.70	5.64	45	
Kuala Pahang, Pahang	87.1	74.1	80.6	89	72	86.2	85.7	11	4	2							212.85	6.85	56	
Mount Faber, Singapore	87.1	75.7	81.4	91	79	81.5	82.5	12	9	3	1						204.40	6.59	54	
Butterworth, Province Wel-lesley	87.6	74.4	81.0	89	71	84.3	85.4	13	11	1	2						187.15	6.04	49	
Bukit China, Malacca	84.6	73.5	79.1	87	70	82.1	83.6	18	16	1							176.00	5.68	47	
Kluang, Johore	87.5	71.1	79.3	91	73	81.6	82.6	14	11	3	9						173.60	5.60	46	
Bukit Lalang, Mersing, Johore	87.9	71.1	79.5	91	73	81.6	82.2	13	13	3							216.80	6.99	57	
Alor Star, Kedah	87.4	74.5	80.9	90	71	86.0	86.4	15	13	4	1					1	146.80	4.74	38	
Kota Bahru, Kelantan	89.0	73.5	81.3	92	76	84.5	85.3	15	13	3							174.10	5.62	45	
Kuala Trengganu, Trengganu	88.0	73.4	80.7	90	71	83.2	84.6	11	9	6	1						179.20	5.78	47	
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang.	73.8	62.0	67.9	78	66	71.4	72.0	10	10	1	4	4					201.75	6.51	53	
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.5	55.9	64.2	76	60	70.3	70.1	15	11	2	8						155.45	5.01	40	
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.7	59.0	65.3	76	68			13	11	2	2						171.25	5.52	45	

Compiled from Returns supplied by the Meteorological Branch, Malaya.

